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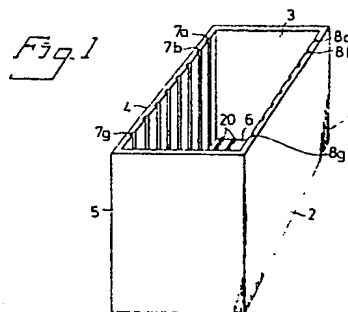
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(54) A plate and a frame therefor.

(57) A plate intended to be put into a frame (1). The plate is characterized by laboratory equipment which is fixed to at least one of the main faces of the plate and which is intended to be used in chemical reactions as well as by connection members located at least at one edge of the plate for connecting hoses, on one hand, and electric wires, on the other hand. The invention also refers to a frame (1) for receiving one or more of these plates. The frame includes grooves (7,8) disposed behind each other for receiving one plate each. The characteristic feature of the frame is at least one coupling plate which is provided with connection members for connection with hoses and connection members for connection with electric wires, the connection members being complementary to the connection members provided on the respective plate.



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A PLATE AND A FRAME THEREFOR

The present invention refers to a plate and a frame for a number of such plates. More particularly, the invention refers to a plate which is provided with laboratory equipment intended to be used in chemical reactions. By laboratory equipment is meant components of chemical nature, such as bottles, test tubes etc., as well as components of mechanical and/or electrical nature, such as, for example, magnetic valves, ovens, thermistors etc.. The frame according to the invention is intended to hold a number of said plates in a sequence behind each other and includes a coupling plate which is provided with connection members which are intended to enter into engagement with complementary connection members provided on the plates. The connection members of one plate are in connection, either communicating connection or electrical connection, with the laboratory equipment of the plate considered. The connection members of the coupling plate are via hoses and electrical wires in connection with external sources, such as, for example, gas tubes, electrical supply assemblies etc., but may also be mutually connected with each other by means of hoses and/or electrical wires.

The basic idea of the invention is that a laboratory is equipped with a "library" of plates and a frame. The chemist selects the plate or plates which are provided with the laboratory equipment necessary for the performance of the chemical reaction and pushes the plates behind each other into grooves provided in the frame. After coupling the connection members of the plates together with the connection members of the coupling plate the chemist carries out the connections which are required between external sources and the coupling plate and between connection members of the coupling plate themselves. Dependent upon the actual construction of the frame said coupling takes place either by

the coupling plate being pressed on to the connection members of the plates or in connection with the plates being pushed into the frame, said coupling taking place at the termination of the push-in movement of a plate into the frame. After all couplings being completed the reaction is carried out.

The plates according to the invention can be compared with conventional printed-circuit cards for electronic equipment, more particularly printed-circuit cards of the kind which are provided with so called card contacts and which are put into so called racks in the back wall of which complementary contacts are provided.

Among the great technical advantages of the plate and the frame, respectively, according to the invention one is that the time consumption for coupling and performing a chemical reaction is considerably reduced compared to the conventional way of coupling and performing the reaction by means of equipment which is placed in individual holders on a table top. The gain of time can be attributed to the fact that all connection members are located on an easily available coupling plate which in addition affords a good general view of the actual coupling. Experiments carried out of the kind described more closely below show that about 3 to 5 times as many reactions can be accomplished per hour if the plate and the frame according to the invention are used compared to the use of conventional technique for coupling the laboratory equipment.

The gain of time mentioned above can advantageously, when carrying out chemical reactions, be utilized in synthesizing starting materials and biologically interesting molecules built therefrom and marked with positron-emitting radionuclides, more particularly ^{11}C . The advantage of using ^{11}C for studying biologically interesting molecules is its short

half-life (about 20 minutes), that it gives off a low radiation dose and that its radiation can be detected outside the body. A problem which is associated with the use of ^{11}C is that its short half-life makes it difficult to have time
5 in the conventional way to carry out a desired synthesis before all the radio-activity has decayed. However, if one can bring about a system of synthesizing ^{11}C -marked molecules within about 1 hour they could really be utilized at a large scale and with great utility in the biomedical basic
10 research and for clinical use.

The frame and plate arrangement according to the invention offers such a system for synthesizing ^{11}C -marked molecules, which system, in addition to eliminating the problem of the great time consumption in accomplishing the syntheses in the
15 conventional way, is compact, shows great flexibility, renders good reproduceability and has good radiation protection. Accordingly, by selecting the plate or plates which are provided with the laboratory equipment required for carrying out the chemical synthesis considered, the operator may
20 carry out the desired synthesis by means of the frame and plate system according to the invention in a safe way under external manipulation. In this way it has been possible to produce ^{11}C -methyl iodide, ^{11}C -formaldehyde, ^{11}C -hydrogen cyanide, ^{11}C -acetic acid starting from $^{11}\text{CO}_2$ and ^{11}C -hydro-
25 gen cyanide starting from ^{11}C -methane in a frame shielded by 5 cms of lead and in the shape of a box having the outside dimensions 50 x 40 x 30 cms.

According to an embodiment of the invention all the connection members (i.e. hose couplings and electrical contacts)
30 of the plate are located at one edge of the plate. The connection members are mounted on the plate at the said edge by means of a holder, for example in the form of an angle which may be fixed to or made integral with the plate. The connection members may also be fixed directly on the plate.

The connection members are of the type which produces the desired connection as a consequence of a substantially rectilinear slip-in movement. When it is a matter of producing a fluid connection the connection members preferably
5 are a hose coupling in the form of a quick-coupling, for example a quick-coupling of the Swagelock-type. When it is a matter of producing an electric connection the connection members are in the form of conventional plug-in contacts, for example card contacts.

10 The frame according to the invention includes pairs of grooves behind each other for receiving one plate each. The frame according to the invention is characterized by the fact that it includes a coupling plate which is provided with connection members for connection with hoses and connection
15 members for connection with electric wires, said connection members being complementary to the connection members provided on the respective plate.

Various embodiments of the invention will be described more closely below in connection with the attached drawing, in
20 which

Fig. 1 shows a perspective view of a frame according to the invention,

Fig. 2 shows a plan view of a plate according to the invention, said plate being provided with certain laboratory
25 equipment,

Fig. 3 is a plan view of another plate according to the invention provided with different laboratory equipment,

Fig. 4 is a plan view of a coupling plate associated with the frame according to Fig. 1,

Fig. 5 is a lateral view of another coupling plate according to the invention, said view showing various types of connection members,

5 Fig. 6 is a perspective view of another embodiment of a frame according to the invention, said frame having a lateral wall which in addition serves as a coupling plate,

Fig. 7 shows a perspective view of another embodiment of a frame according to the invention, and

10 Fig. 8 is a plan view of another embodiment of the plate according to the invention.

Fig. 1 shows a frame, a so called rack 1 which includes a box-like structure having lateral walls 2 to 5 and a bottom wall 6. The structure is open at the top. Grooves 7a to 7e are provided in the lateral wall 2 equally spaced and running
15 vertically. In the same way grooves 8a to 8e are provided in the lateral wall 4. The groove 7a is located opposite the groove 8a, 7b opposite 8b etc. to form pairs of guide grooves lying behind each other for receiving a plate described more closely below.

20 Fig. 2 shows a front view of a plate 9a according to the invention. The plate is rectangular and can be pushed in between any of the abovementioned pairs of grooves. The plate has fixed to it two bottles 10 and 11 each of which has a number of connections 12. By means of tubings, for
25 example of plastic, and multi-way valves 13 the connections 12 are branched or connected among themselves, respectively, between the two bottles. Certain connections are taken direct to a connection member 14. The branchings are also by means of tubings taken to other connection members 14. All
30 the connection members 14 are fixed to a holder 15 provided adjacent one edge of the plate. This holder may consist of

a strip fixed at the top edge of the plate or may be made integral with the plate 9a. The connection members 14 preferably are of a quick-coupling type. Female-type contacts are chosen for input tubings, while male-type contacts are chosen for output tubings, whereby the risk of miscouplings is eliminated to a certain extent. The multi-way valves 13 are electrically manipulated, and the electric wires to the valves are taken to connection members 16 which are fixed to the holder 15. The connection members 16 are in the form of electric contacts which are of a plug-in type, for example female contacts. The plate 9a is provided with a cut-out portion 17 the purpose of which is described more particularly below.

The material of the plate and the material of the frame is not critical. Preferably a material is chosen which is inert with regard to the chemical reactions to be accomplished. The material should be stiff and easy to work. It may be an advantage if the material is transparent. As examples of suitable materials PVC, plexiglass, glass fibre, board etc. may be mentioned.

Fig. 3 shows a plate 9b which is provided with other laboratory equipment than that shown in Fig. 2. An electric oven 18 is fixed to the plate by conventional fixing means, not shown. Inlet and outlet for the oven takes place by tubings which are taken to connection members 14 which are constructed in the same way as those shown in Fig. 2. Electric wires to a thermocouple 19 disposed in the oven are taken to connection members 16 which are similar to those shown in Fig. 2. The connection members 14 and 16 are located on a holder 15 corresponding to that shown in Fig. 2. The plate 9b is also provided with a cut-out portion 17.

The plate 9a is pushed into the pair of grooves 7a, 8a, while the plate 9b is pushed into the pair 7b, 9b. The cut-outs 17

in the plates 9a, b permits that a carriage not shown can be moved between the plates 9a, b placed behind each other in the frame. The carriage runs on rails 20 shown in Fig. 1 and arranged on the bottom wall 6. The carriage is used, for example, for taking out samples from laboratory equipment on a plate and transporting the sample to laboratory equipment on a different plate provided in the same frame.

Fig. 4 shows a coupling plate 21 which is provided with connection members which are complementary to the connection members provided on the plates 9a, 9b and are located in positions lying opposite the corresponding connection members of the plates. The coupling plate 21 is either a loose separate unit or a unit pivotally mounted on the frame 1. Fig. 4 shows the connection members provided on the coupling plate 21 in the case where the plates 9a and 9b are pushed into the grooves 7a, 8a and 7b, 8b, respectively, in the frame of Fig. 1. Fig. 4 shows the side of the coupling plate facing the plates 9a, 9b pushed into the frame. The coupling plate 21 is placed as a cover over the open top of the frame 1 and is pressed on so that the connection members thereof as shown in Fig. 4 will engage the connection members 14, 16 of the plates 9a, b. Connections of external equipment that may be required, such as gas sources, current sources, printers, control equipment, monitoring equipment, are then performed by connecting hoses, electric wires etc. to the connection members of the coupling plate 21. Laboratory equipment on one plate can be connected with laboratory equipment on another plate provided in the frame or on plates which are provided in another frame placed in connection with the frame shown in Fig. 1.

The invention has been described above in connection with plates where the connection members are located at the top edge of the plate, but it is understood that the connection members may be located at other edges of the plate, for example at its bottom edge or at one of the lateral edges

of the plate. According to the invention it is also possible to locate the connection members for hoses at one of the edges of the plate, while connection members for electric wires are located at another edge of the plate, preferably the opposite edge. Also, the plates need not be pushed vertically into the frame but may be pushed in from one side as is exemplified in Fig. 6 which shows a frame one lateral wall of which is provided with connection members 14, 16 and serves as a coupling plate 21. These connection members 14, 16 are complementary to the connection members on the plates. The top wall of the frame and the bottom wall thereof are provided with parallel, opposite grooves corresponding to the grooves 7, 8 shown in Fig. 1.

From Fig.s 2 and 3 it is seen that the connection members 14 and 16 are mixed without any mutual order. This may be a source of miscouplings. Therefore, it is within the scope of the present invention that the electric contacts on one hand and the hose couplings on the other hand are located in predetermined areas of the holder 15. For example, the electric contacts 16 may be located in an area in the middle of one edge of the card while hose couplings of the female type are located at one side of the electric contacts 16 and male-type hose couplings are located at the opposite side of the electric contacts 16. The coupling plate 21 will then get a uniform appearance as is seen from, for example, Fig. 6 where female-type quick-couplings are located at the top, the electric contacts 16 are located in the middle of, and the male-type hose couplings are located at the bottom of the lateral wall of the box-like structure.

Fig. 7 shows still another embodiment of a frame 1 in the form of a box skeleton, i.e. the box is without lateral, bottom and top walls and is instead formed by rods 22 fixed, for example soldered, to each other. Strips 23, which are substantially of U-shape in cross-section, are fixed, for

example soldered, in pairs between opposite pairs of rods to form grooves corresponding to the grooves 7a to h and 8a to h.

5 Fig. 5, in cross-section, shows a coupling plate 21 having in turn, counted from above, a female-type hose coupling, a male-type hose coupling and a male-type electric contact. The connection of the connection members to the plates takes place at the right-hand side of the connection members, as seen in Fig. 5, while connections to external sources are
10 accomplished at the left-hand side of the connection members shown in Fig. 5.

Finally, Fig. 8 shows a plate 9c on which the connection members for hoses have been located at the top on the edge of the plate, while the connection members 16 for electric
15 wires have been located at the opposite bottom edge of the plate. The electric connection members may then be directly fixed to the plate, for example by soldering, screwing etc. or alternatively they may, similarly as the connection members, be fixed to a strip. It is understood that the plate
20 9c is used together with a frame the bottom wall of which is provided with complementary electric connection members located right under the connection members 16 while the coupling plate 21 has connections only for hoses. This helps to making the coupling plate more clear.

25 Similarly, the electric connection members 16 shown in the frame of Fig. 6 may be located on a separate, additional coupling plate, not shown, which after a suitable number of plates being pushed into the grooves of the frame closes the opening of the frame.

30 The frames shown in Figs. 1, 6 and 7 may, in the case of performing chemical reactions with radioactive materials, be lined with lead plates and plates of lead glass. A video camera may be placed in the frame so that the chemist may

superwise the course of reaction visually.

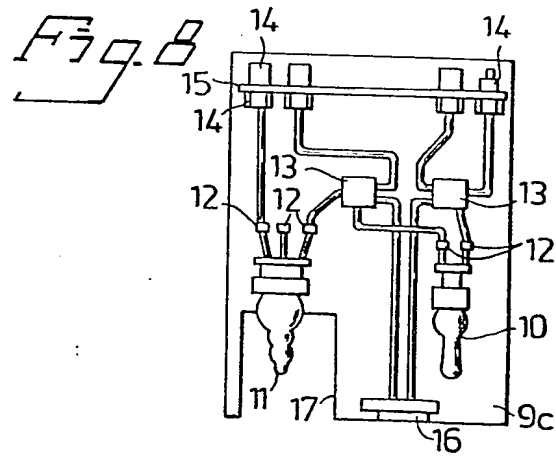
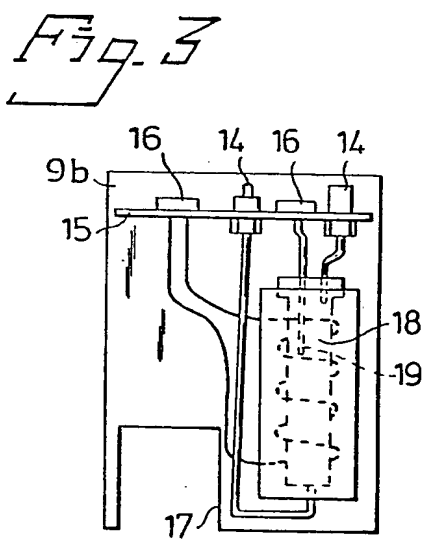
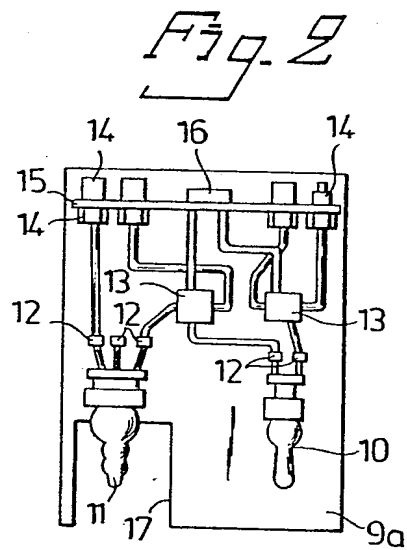
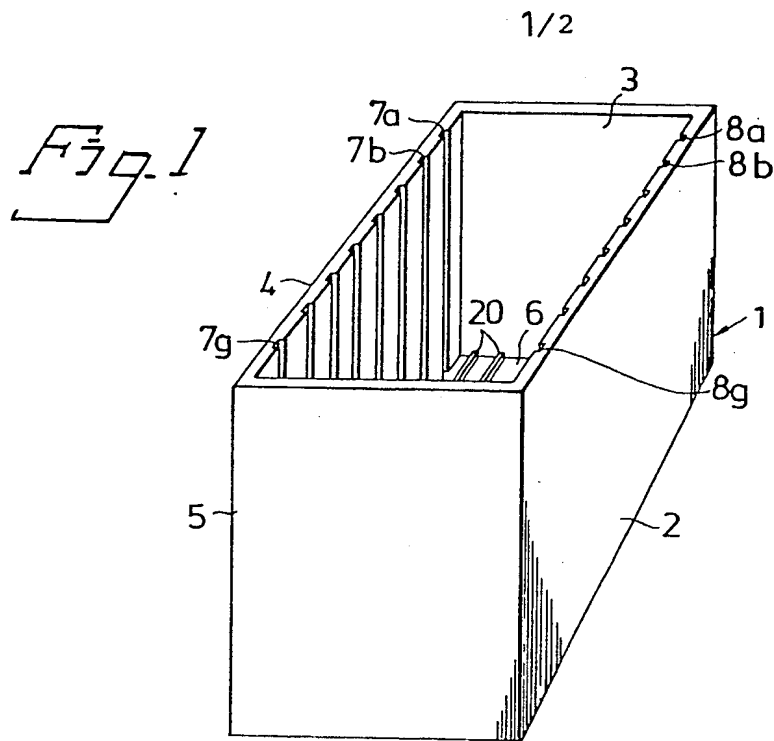
The feature of the rails 20 and the cut-outs 17 in the plates 9 may be omitted in a frame and a plate, respectively, according to the invention.

- 5 The embodiments of the invention described above may be modified and varied in many ways within the scope of the basic concept of the invention.

CLAIMS

1. A plate (9a,b) intended to be put into a frame (1), characterized by laboratory equipment (10 to 13,18,19) which is fixed to at least one of the main faces of the plate and which is intended to be used in chemical reactions, and by connection members (14,16) located at least at one edge of the plate for connecting hoses on one hand and electric wires on the other hand.
2. A plate according to claim 1, characterized by a holder (15) extending adjacent said edge, the connection members (14,16) being fixed to said holder.
3. A plate according to claim 2, characterized by the fact that the connection members (14) for hoses and the connection members (16) for electric wires are located in predetermined areas of the holder (15).
4. A frame (1) intended for receiving one or more plates (9a,b) according to claim 1, said frame including grooves (7,8) arranged behind each other for receiving one plate each, characterized by at least one coupling plate (21) which is provided with connection members (14) for connection to hoses and connection members (16) for connection to electric wires, said connection members being complementary to the connection members provided on the respective plate.
5. A frame according to claim 4, characterized by the fact that a coupling plate is provided with connection members (14) for conduits while another coupling plate is provided with connection members (16) for electric wires.
6. A frame according to claim 4 or 5, characterized by the fact that at least one coupling plate forms a cover for the frame, that the grooves (7,8) run vertically and that the frame is in the form of a box.

7. A frame according to claim 4, characterized by the fact that it consists of a box-like skeleton (22) and that the grooves (7,8) consists of strips (23) substantially U-shaped in cross-section and mounted in the skeleton.
- 5 8. A frame according to claim 4, characterized by the fact that a coupling plate (21) is a lateral wall of the box and that the grooves (7,8) extend horizontally.
9. A frame according to claim 8, characterized by the fact that another coupling plate forms the opposite lateral wall of the frame, that the lastmentioned coupling plate carries connection members which are complementary to the electric connection members, while the first-mentioned coupling plate carries connection members which are complementary to the connection members for hoses, or vice versa.
- 10 10. A frame according to any of the preceding claims, characterized by the fact that plates of lead and/or lead glass surround the frame.
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Fig. 4

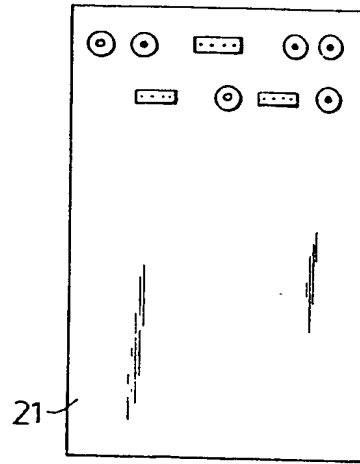


Fig. 5

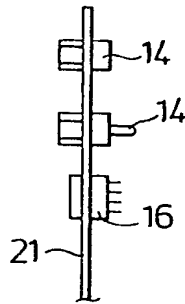


Fig. 6

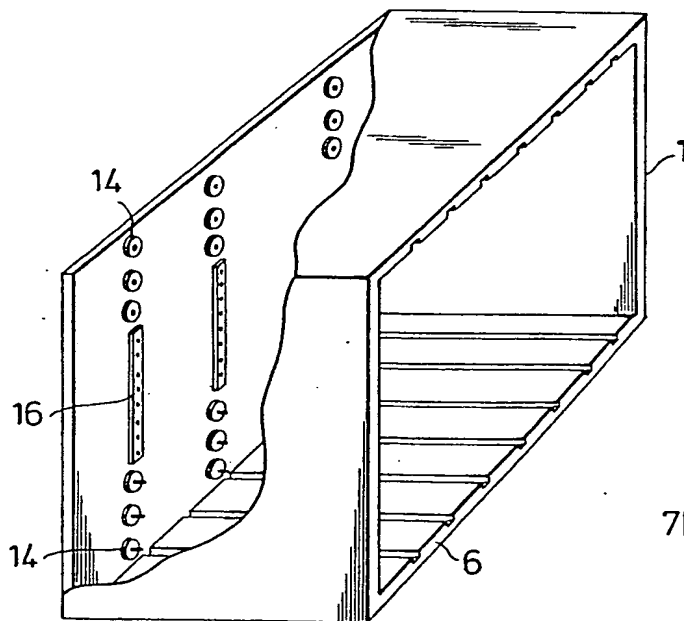
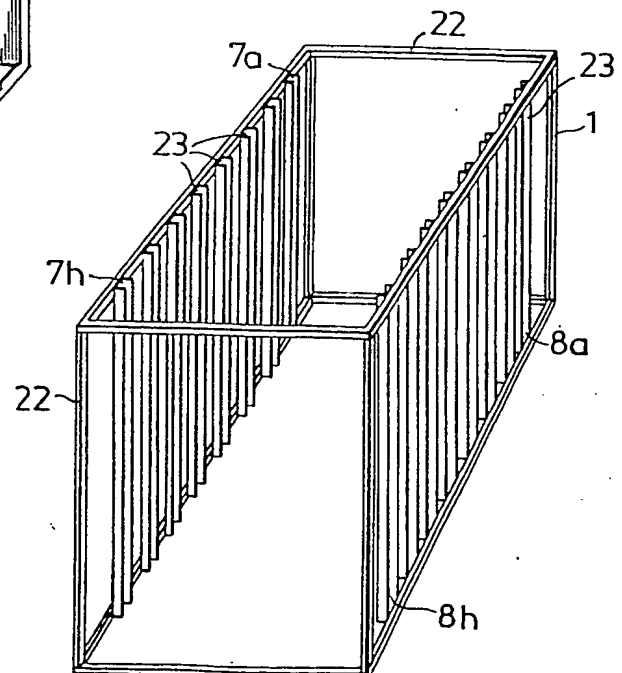


Fig. 7





European Patent
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EUROPEAN SEARCH REPORT

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Application number

EP 81 85 0074

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	<u>US - A - 3 623 166</u> (WILKINSON). * Column 3, line 43 to column 4, line 58 * --	1,2	B 01 L 11/00 G 01 N 35/00
	<u>DE - A - 2 623 712</u> (SIEMENS) * Claims 1,2,4,6,9 * --	1	
A	<u>US - A - 3 327 204</u> (HILLIER) * Claim 9 * --	1	TECHNICAL FIELDS SEARCHED (Int. Cl.)
A	<u>US - A - 3 704 394</u> (JOHNSON) * Column 3, lines 4-53 * --	6,7	B 01 L G 01 N G 09 B H 05 K
A	<u>US - A - 3 723 823</u> (LIT et al.) * Column 2, line 53 to column 3, line 3 * --	7,8	
A	<u>DE - A - 2 528 152</u> (RATIOMED)	1,8	
A	<u>GB - A - 1 376 219</u> (FESTO) * Page 1, lines 11-21 * ----	1	CATEGORY OF CITED DOCUMENTS X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons &: member of the same patent family. corresponding document
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21-07-1981	Examiner LAMMINEUR